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A Note on Cover Crops in Relation to Root Diseases of Rubber.

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SINCE the introduction of cover crops as a general measure on most Rubber estates in Ceylon, the question has arisen as to how far these crops will favour the spread of root disease.

It is not necessary here to consider in any detail the conflicting views held as to the causation of root disease, but we must at once distinguish between the fungus *Rhizoctonia bataticola* on the one hand, and the fungi commonly associated with root disease such as Fomes (*lignosus* and *lamaoensis*), Poria and Ustulina on the other. Our present knowledge leads us to believe that *Rhizoctonia* does not spread through the soil by contact, whereas the other fungi do. It would appear, therefore, that the occurrence of the former fungus has no bearing on the present subject except in so far as its presence on a cover plant may be necessary before that plant is attacked by Fomes, Poria, or Ustulina. *Rhizoctonia* has so far been reported by Small as occurring on *Tephrosia candida*, *Crotalaria* sp., *Desmodium heterocarpum*, and *Clitoria cajanifolia*, of the commonly used covers. Whether the fungi which have in the past been supposed to cause root disease are primarily responsible or not, it seems almost certain that they are at least secondary parasites and hasten the death of the trees which they attack. As such they are of importance to the practical planter and must be guarded against. In the following notes, therefore, these fungi will be referred to as causing root disease of Hevea without however assuming that they are the primary causative agents.

We may distinguish between:—

- (1) Erect Covers,
- (2) Creeping Covers.

(1) **Erect Covers.**—These include such species as *Tephrosia candida*, *Crotalaria* sp., *Clitoria cajanifolia*, etc. Most of these erect covers become woody after one or two years' growth, and are then liable to be attacked by the fungi which cause root disease of Hevea.

It is clear that a crop interplanted with Rubber and susceptible to attack by any of the root fungi to which the Rubber is liable, will aid in the spread of the fungus if this spreads by contact. A good example of this has recently been under the writer's observation. An old tea field, about 60 acres in extent, had been cleared and planted with Rubber about 3 years ago. The whole area was planted up with *Crotalaria* sp. and portions with *Dolichos hosei* (*Vigna*). The tea stumps have not been removed, and in February, 1928, a considerable amount of the fungus *Fomes lignosus* was found on the Rubber and *Crotalaria*. The fungus occurred in patches throughout the whole area and had apparently been responsible for the death of many Rubber saplings and *Crotalaria* plants. Many cases were noted of *Fomes mycelium* passing from roots of *Crotalaria* to those of the Rubber and *vice versa*. There can be little doubt that the presence of the *Crotalaria* among the Rubber had aided the spread of the *Fomes*.

Tephrosia candida, when old and woody, may be attacked by *Poria hypobrunnea*, while the writer has also found *Fomes lignosus* on this cover. *Fomes lamaoensis*, the fungus causing Brown Root disease, has been found on *Crotalaria* sp. in association with *Fomes lignosus*, *Diplodia*, and *Rhizoctonia bataticola*. It is probable that associations of these fungi with other species of cover crops will be noticed as the use of cover crops is extended.

The obvious corollary to the fact that most erect covers become liable to attack by root disease fungi when they become woody is that a time limit must be set to their growth. It is usually considered that *Tephrosia candida* should be taken up after two years while a corresponding limit may be set to the age of other covers of a similar nature. It is not sufficient merely to cut the plants down: the stumps must be extracted and burnt. If left in the ground they may be attacked by *Fomes*, *Poria* or *Ustulina* and become centres of further infection.

(2) **Creeping Covers.**—Most of the observations made in connection with the relation of creeping cover crops to root disease refer to *Dolichos hosei* (*Vigna oligosperma*), though the conclusions arrived at are probably equally applicable to such species as *Centrosema pubescens*, *Calopogonium mucunoides*, etc.

Whereas in the case of erect covers the spread of root disease may be favoured by the cover plants themselves being liable to the disease, in the case of creeping covers the effect is more indirect though possibly more marked. As far as is known none of the creeping covers grown under Rubber are parasitised by any of the fungi causing root disease of Hevea.

Probably the most important means by which the growth of Vigna influences the spread of root disease is in causing moist conditions in the surface layers of the soil, as such conditions favour the growth and spread of the mycelia of the fungi which cause disease. A striking instance of this was recently observed by the writer. Two or three trees growing in a rocky ravine were seen to show symptoms of root disease in the aerial portions. The ground was carrying a luxuriant growth of Vigna which covered up many rocks and boulders, and on rolling this back the presence of *Fomes lignosus* was disclosed. The fungus was apparently in a very active condition mainly due to the moist conditions under the Vigna. The mycelium was growing freely over stones and boulders which, had they been exposed to the sun and air, would have offered no medium for the spread of the fungus. The apparent source of infection was a rotten jungle log, and the fungus had spread outwards in all directions to the extent of about $\frac{1}{2}$ acre. Only two or three trees in the middle of the area showed in their foliage definite symptoms of root disease; this indicates the rapidity with which the fungus had spread.

Another phenomenon which was noted on the above mentioned area, and which has been observed on other estates is the growth of mycelial strands of Fomes along the older runners of the Vigna. The Fomes does not appear in any way to harm the Vigna, but merely spreads along it. A case has been seen of a tree being infected with *Fomes lignosus* at the collar, the mycelium having reached the tree along the Vigna. The lateral roots, where they joined the collar, were quite free from the fungus, so that the mycelium had spread more quickly along the Vigna than underground.

On one estate young immature fructification of *Fomes lignosus* were found growing on a tangled mass of dead Vigna runners, and it would appear, therefore, that although Fomes is not parasitic on Vigna it can live as a saprophyte on the dead tissues. Consequently where there is a well established cover of Vigna there is a suitable medium for the growth of Fomes.

An indirect means by which Vigna may aid in the spread of root disease is by concealing it, so that its detection is rendered more difficult. A tree was recently seen on the trunk of which fructifications of *Fomes lignosus* were growing up to a height of nearly a foot. These had been completely concealed by a thick cover of Vigna as also had the mycelium on the lateral roots near the collar. The tree was nearly dead and should have been noticed earlier, but it is probable that had the Vigna not been present the disease would have been detected at the first appearance of a fructification. This difficulty is easily overcome by keeping a circular area of about 8 ft. in diameter round every tree clear of Vigna. The detection of root disease, and more especially of Ustulina collar rot, is thereby made easier. Once the circle has been cleared it can easily be kept clean by the scrappers or tappers.

In conclusion it should be understood that the assistance in the spread of root disease fungi by cover crops is not in itself an argument against growing them, and it would be a mistake for an estate to deny itself the undoubted benefits to be derived from these crops because of the possible danger from root disease. It is, however, recommended that cover crops, and in particular Vigna, should not be grown in areas known to be affected with root disease, and if already established they should be cleared away.

Summary of a Report on "Causes of Variation in Plasticity."

A full report on the "Causes of Variation in Plasticity" of rubber is in the press and will shortly be issued as Research Scheme Bulletin No. 49.

"In view of the demand for rubber of uniform plasticity, the question of the extent and causes of the variation in the plasticity of plantation rubber is receiving considerable attention both in Java and Ceylon. In tests carried out at the Imperial Institute marked differences were found in the plasticity of samples from a number of Ceylon estates and a detailed study of the causes of this variation has been commenced.

"Specimens of rubber for use in these investigations were specially prepared in Ceylon by Mr. O'Brien and were tested at the Imperial Institute by the London Staff of the Scheme six months after preparation by the methods described in Bulletin 47.

"The samples consisted of crepe prepared by (1) keeping the coagulum in the serum for different periods before rolling; (2) passing the coagulum through the rollers for different numbers of times; (3) adding different amounts of sodium bisulphite to the latex; (4) coagulating latex of different dilutions; and (5) passing dry crepe through different types of rolls to convert it into blanket crepe.

"The results of the experiments indicate that some of the methods of preparation employed have a marked effect on the plasticity of the rubber as shown below:—

Treatment.	Effect on plasticity.
Keeping coagulum in serum (maturation).	Marked decrease.
Passing coagulum through rollers for different numbers of times.	Marked increase when coagulum is rolled excessively.
Addition of sodium bisulphite to latex.	Marked decrease.
Coagulating latex of different dilutions.	Little effect.
Passing dry crepe through different types of blanketing rolls.	No definite conclusion.

"The period during which the coagulum is kept in the serum before rolling and the amount of bisulphite added to the latex appear to be two causes which may effect the plasticity of commercial grades of rubber. These conclusions are provisional and require confirmation, but it is evident that it will be necessary to pay considerable attention to both these points in future investigations.

"It has also been shown incidentally in the course of these experiments that drying crepe in hot air causes a considerable increase in plasticity. This is of importance in connection with the preparation of blanket crepe and also suggests a reason why smoked sheet is usually more plastic than air-dried sheet. These questions are still under investigation.

"Conclusions."—The results of experiments described in the report indicate that six months after preparation

(1) Crepe rubber prepared by machining the coagulum 3 hours after coagulation is about 80 per cent. more plastic than when prepared by machining the coagulum 40 hours later.

(2) Crepe rubber is nearly twice as plastic when prepared from coagulum machined more than 20 times instead of the usual number of times.

(3) Crepe rubber is about 50 per cent. more plastic when prepared from latex containing no bisulphite instead of the amount officially recommended.

(4) Crepe rubber is only slightly more plastic when prepared from very dilute latex instead of from concentrated latex or latex of normal dilution.

(5) Machine-dried crepe may be as much as 50 per cent. more plastic than air-dried crepe, and the type of rolls (whether water-cooled or air-cooled) may have an important effect on the plasticity of blanket crepe.

"Dr. de Vries has shown that the plasticities of some rubbers change considerably on keeping at tropical temperatures. The above samples were kept for about four months in the London laboratories of the Scheme in addition to a short period in Ceylon and the time occupied in transit. The conditions to which the samples were subjected are therefore similar to those occurring in practice. The effects of storage at temperatures below tropical are now under investigation.

"In connection with these experiments it is of importance to point out that none of the methods employed in the determination of plasticity give results which bear a known relation to a strictly defined physical property. The methods were devised by manufacturers, and the results are stated by them to correlate closely with factory experience.

"Concurrently with the above experiments a considerable amount of work has been carried out at the Imperial Institute with a view to a closer understanding of the principles involved in determinations of plasticity, and the results so far obtained indicate that too much importance should not be attached to the percentage differences between the samples, as the relationship appears to vary with small differences in the conditions and methods of testing. It is unlikely however that the conclusions drawn in this report concerning the direction of the effect of different methods of preparation on the plasticity of crepe will be influenced by any subsequent changes in methods of testing which may be found necessary."

A Preliminary Note on A Rust on *Dolichos Hosei* (Vigna.)

A recent examination of brown angular spots on the leaves of *Dolichos Hosei* has revealed the presence of a fungus belonging to the class known as "Rusts" or Uredinales. Sori of 1-celled sessile teleutospores occur on the discoloured spots on the under side of the leaflets, and are visible under a lens as minute circular pustules. The fungus is probably a species of *Uromyces*, a genus which causes disease on other Vignas and beans.

The spots are irregular in shape and angular in outline, being usually delimited by ramifications of the leaf veins. They occur scattered throughout the leaf-blade but are usually more numerous at the margin and tip, where they commonly join up to form larger irregular dead areas. Badly affected leaflets turn yellow, starting from the tip, and fall from the petiole. In areas where a large number of leaves are affected the cover presents a yellow and thin appearance.

The importance of this fungus as a disease factor on Vigna is not yet known, and until further investigations on the association of the fungus with the yellowing and death of the leaves have been made, no recommendations as to its control can be given. The disease is commonly found in almost any field of Vigna and usually appears to do little harm. It is possible that only under certain circumstances does the disease become an epidemic and actually kill the Vigna plants. The rusts are obligate parasites and, as a group, are responsible for many important diseases of economic plants. The damage caused by Coffee Rust (*Hemileia vastatrix*), for example, is well known to Ceylon planters. The occurrence of a rust on Vigna must therefore be regarded as at least a potential menace to this cover and any seriously damaged areas should be reported to scientific officers of the Rubber Research Scheme.

R. K. S. MURRAY.

Book Review.

The Department of Agriculture has been favoured with the following publications:—*Importance of an Adequate Intelligence Service for the Rubber Industry*; *Summary of Current Literature*; and *Library Catalogue*, issued by the Research Association of British Rubber and Tyre Manufacturers.

The first is a paper read by S. S. Pickles, D.Sc., F.I.C., Chairman of the Library and Information Bureau Committee of the Research Association of British Rubber and Tyre Manufacturers, at a meeting of the London Section of the Institute of the Rubber Industry on December 7, 1925. In this paper Dr. Pickles discusses fully the importance of an Information Bureau for the Rubber Industry and urges first, the need for the provision of a special rubber library for collecting and arranging in the best accessible manner all available literature on the rubber and allied industries and second, presenting such information as has been gathered from the above literature in a form in which it can be readily absorbed and utilised by the recipients. He suggests that such a venture could be economically undertaken by the co-operation of the different Institutes and Associations and in establishing a central library. In this connection as an alternative proposal he suggests the Institute to take advantage of the library of the Research Association of British Rubber and Tyre Manufacturers at Croydon and praises highly the work that is being done by the research staff of that Association with regard to the issuing of the *Summary of Current Literature*, and the services of this staff, he says, will be at the disposal of the Institution of the Rubber Industry. Further he hopes that with the establishment of an Information Bureau on the lines proposed by him it will be possible with the aid of the Depart-

ment of Overseas Trade and the Statistical Department of the Board of Trade to issue commercial statistics in the form of a trade supplement to the *Summary of Current Literature*.

These suggestions made by Dr. Pickles, as is shown by the discussion following upon the paper, if realized, would be in the best interests of the rubber industry as a whole.

The *Summary of Current Literature* (Received Vol. VI, No. 3, March, 1928) is a publication issued monthly embodying a summary of the contents of all the important technical and scientific journals dealing with the rubber industry and which appeared since the preceding issue of this publication. The work of abstracting suitable information from current literature is in the hands of a staff of highly scientific and efficient officers of the Information Bureau of the Research Association of British Rubber and Tyre Manufacturers and it has correspondents all over the rubber growing world. The fact that the *Summary* has been divided into different sections that come under the industry has facilitated matters for the reader and in our opinion such facilities would be enhanced if an index is attached to each issue. The value of this publication to those engaged in the rubber industry, especially on the technical side of it, cannot be exaggerated.

The *Library Catalogue* is an efficiently got up book containing the titles of a very wide collection of British and foreign publications dealing with the rubber and allied industries. The different kinds of entries viz. title, author, subject, etc., are made in distinctive types and are arranged in alphabetical order enabling easy reference. A list of rules governing reference and the loan of books is included in the Catalogue.

NOTICES.

SUBSCRIPTIONS.

Arrangements have now been made for Bulletins of the Ceylon Rubber Research Scheme to be made available to non-contributors to the Scheme at the rate of Rs. 15-00 per annum, post free.

OFF-COLOURED CREPE.

The Chemist to the Rubber Research Scheme would be glad to get into touch with the Superintendent of any estate who is troubled with off-colour crepe, and who thinks that this may be due to impurities in the water used for manufacture.

GLASS METROLOCS.

Glass Hydrometers for testing latex as specified and as recommended by the Rubber Research Scheme (Ceylon) may be obtained at a cost of Rs. 12-50 each from :—

Messrs. WALKER, SONS & Co., Ltd.,
Engineering & Estate Supplies Department,
Colombo.

